Universal Lathe and Jig Bore Fixture Holder

Adaptable Fixture Standardizes Setup Procedure and Facilitates Machining of Parallel Parts

Innovation by JOHN R. SEALY

Personnel of the Beryllium Facility Machine Shop of the Astrionics Laboratory are continually looking for new methods and techniques to improve their capability to perform precision machine work. Their efforts turned up an important shop aid in a fixture holder that can be used with a lathe or a jig bore and allows transfer of a part from one machine to the other with a minimum of setup time. The fixture holder increases accuracy in machining parallel parts in addition to standardizing setup methods and procedures for both the lathe and jig bore.

The fixture holder (fig. 21) is made of hard-anodized aluminum to resist wear. It has two

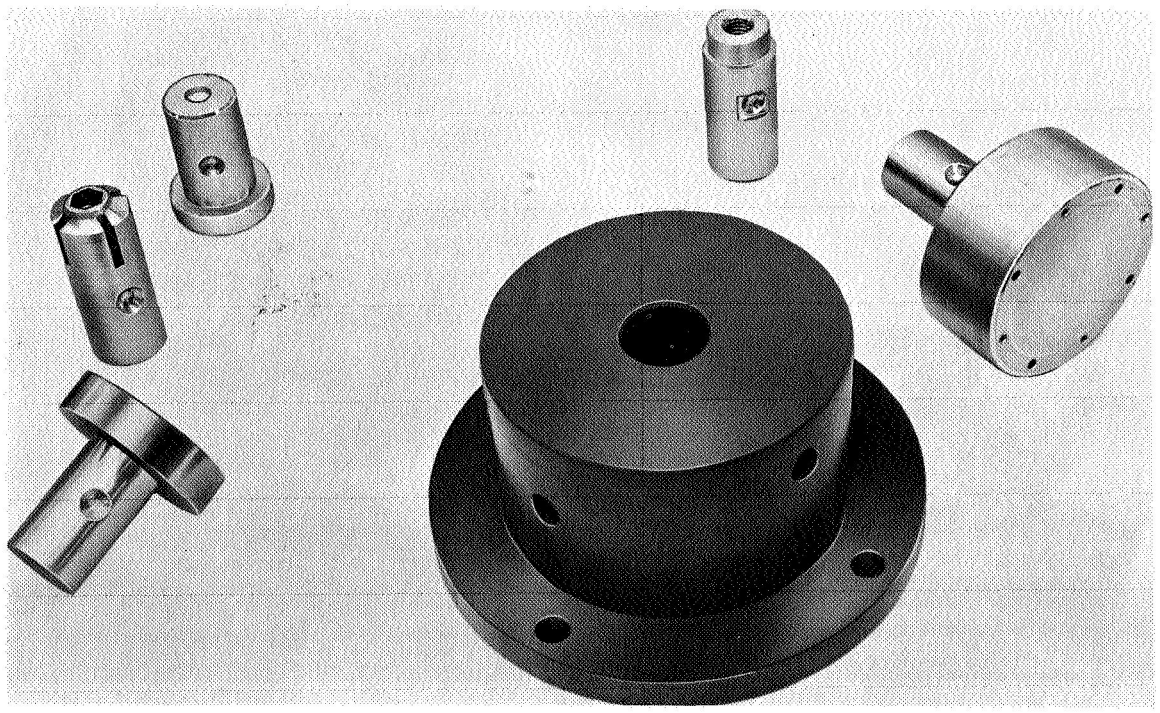

FIGURE 21.—Lathe and jig bore fixture holder and variety of one-inch brass inserts.

lapped faces that are parallel to within 5-millionths of an inch. Each face has a 1-inch hole through the center, perpendicular to the parallel-lapped faces. The holes are equally sized and lapped to within 20-millionths of an inch. A 3/8-inch setscrew in the side of the fixture is provided to lock an alinement insert in place.

A variety of brass inserts may be used interchangeably with fixtures mounted on a lathe and a jig bore, depending on the operation required. The inserts have shanks that fit the 1-inch hole in the fixtures with a clearance of one ten-thousandths to two ten-thousandths of an inch. For work on high-precision parts, such as air bearing end plates that require a high degree of parallelism, a split insert with a tapered-head screw in the end is used to lock the part in place. (See fig. 22.) The bore of the end plate is slipped over the insert, locked in place and tapped back against the true face of the fixture (fig. 23).

Another type of insert used with the fixture is solid, with a tapped hole in the end. The work piece is slipped over the lineup screw and locked in place with a screw and large washer.

PREPARATION FOR USE

A lathe, to be used with the fixture, is first prepared by mounting a stress-relieved backup plate to the face plate. The backup plate is cut as true and perpendicular to the axis of the lathe as the runout of the lathe spindle bearing will permit. The precision of this part can be

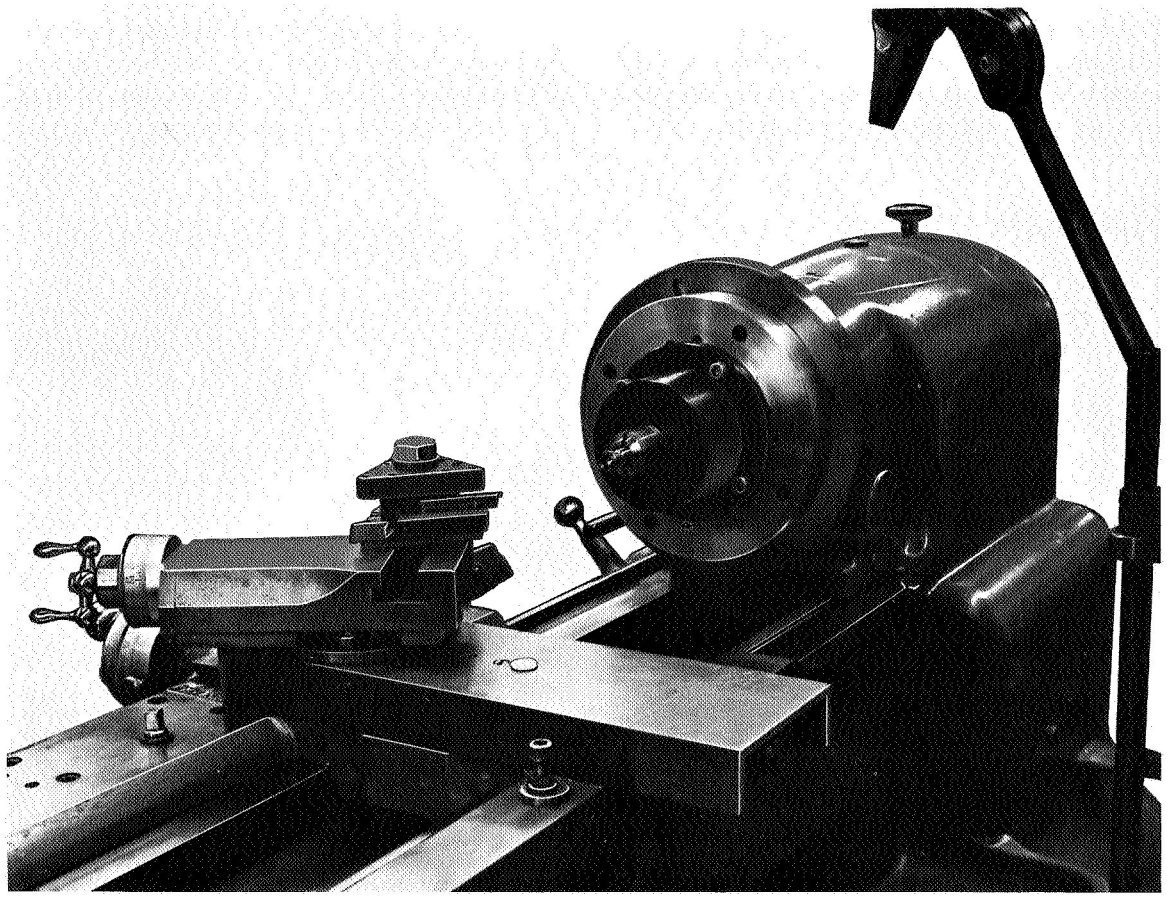

FIGURE 22.—Lathe-mounted fixture holder with split-brass insert displaying tapered screw.

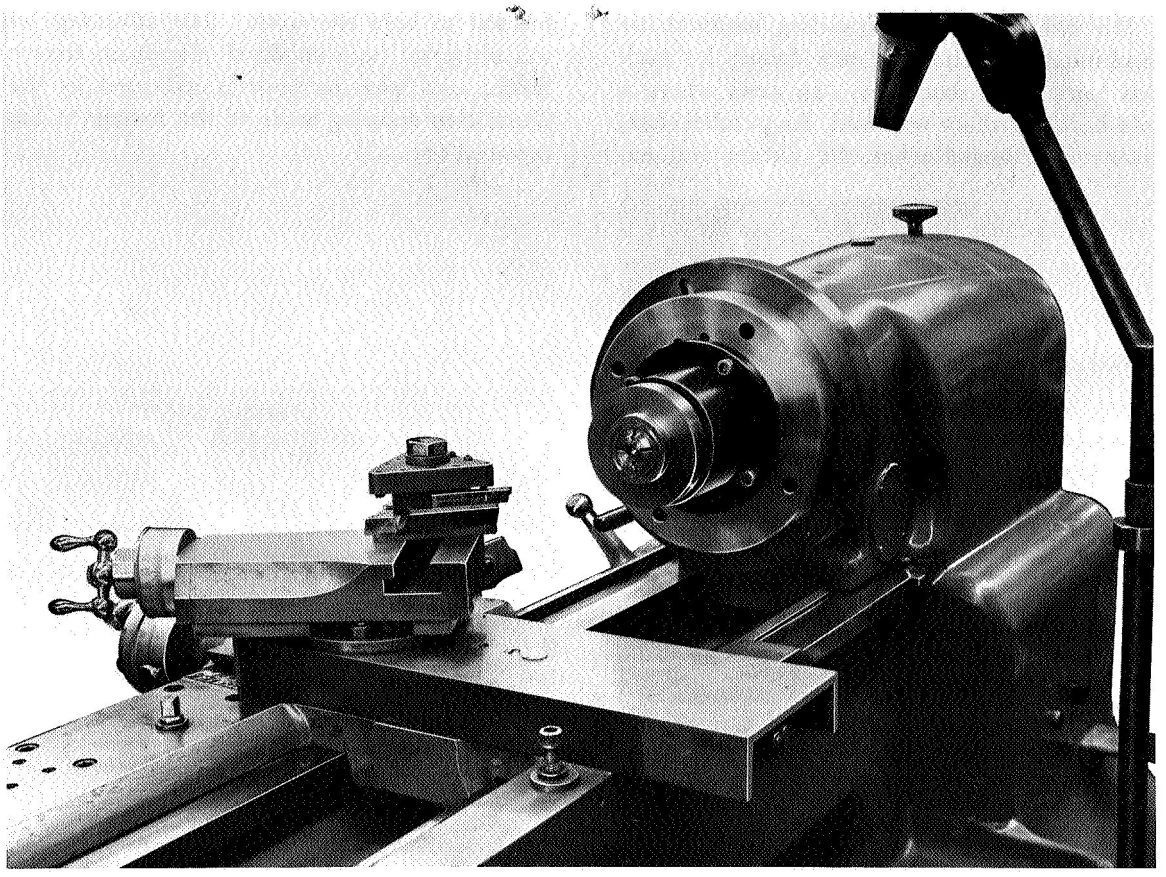

FIGURE 23.—Air bearing end plate (prior to machining) mounted on fixture holder utilizing split-brass insert.

improved by making a number of passes on the backup plate without moving the lathe carriage.

The fixture holder is lapped front and rear to make it true and parallel. The center hole is then bored and lapped concentric with the lathe axis and perpendicular to the two faces. The surface of the fixture is then hard anodized. After the anodizing, the front and rear faces are lapped parallel to within 5-millionths of an inch. The hole is then lapped to a smooth finish parallel to the lathe axis.

The prepared fixture holder is mounted to the backup plate with mounting studs and is trued with an air gage to within the limits of the lathe spindle bearing runout. The runout limits of the spindle bearing may vary between 18-millionths and 35-millionths of an inch.

Of 10 pieces machined with the use of three fixture holders, 7 were within 20-millionths of an inch of parallel, and the remaining 3 were within 50-millionths of an inch. Specifications called for parallelism within 35-millionths of an inch after the parts were lapped. These dimensions were held, despite the lathe spindle bearing runout, by making multiple runs on each cut without changing the lathe carriage position.

When used with a jig bore, the fixture is mounted directly on the precision turntable (fig. 24).

The old method of paralleling required the machining of a complete new fixture for each new part to be machined. In cases where a split backup surface was used, the parallel characteristics changed when the fixture was expanded to hold the work. The advantage of the universal hard-anodized aluminum fixture holder over past methods is indicated by the illustration showing some of the fixtures it has replaced (fig. 25).

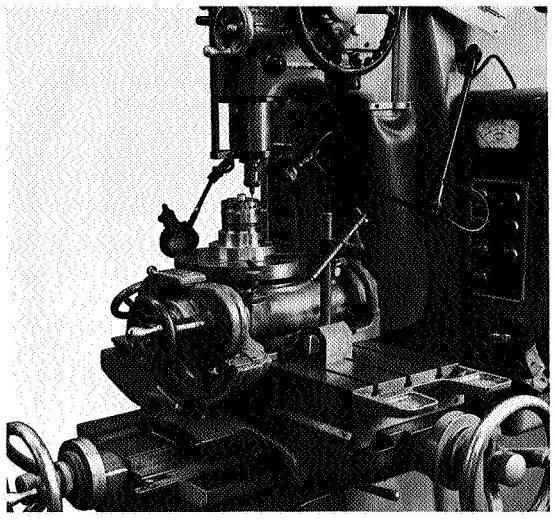

FIGURE 24.—Gyro housing mounted to jig bore precision turntable utilizing special fixture.

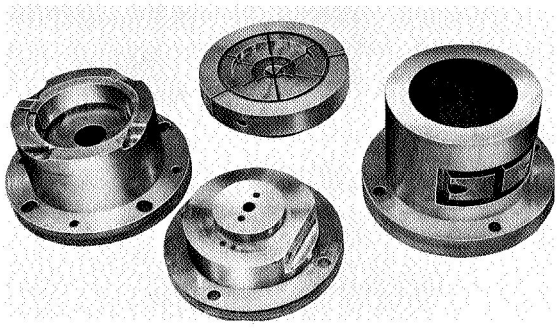

FIGURE 25.—A sample of fixtures replaced by new precision hard-anodized aluminum fixture holder.